

LA-UR-22-20376

Approved for public release; distribution is unlimited.

Title: Traditional Method for Amplifier Matching for NDA Detector Systems

Author(s): Rael, Carlos D.

Intended for: Training Presentation

Issued: 2022-01-18



Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

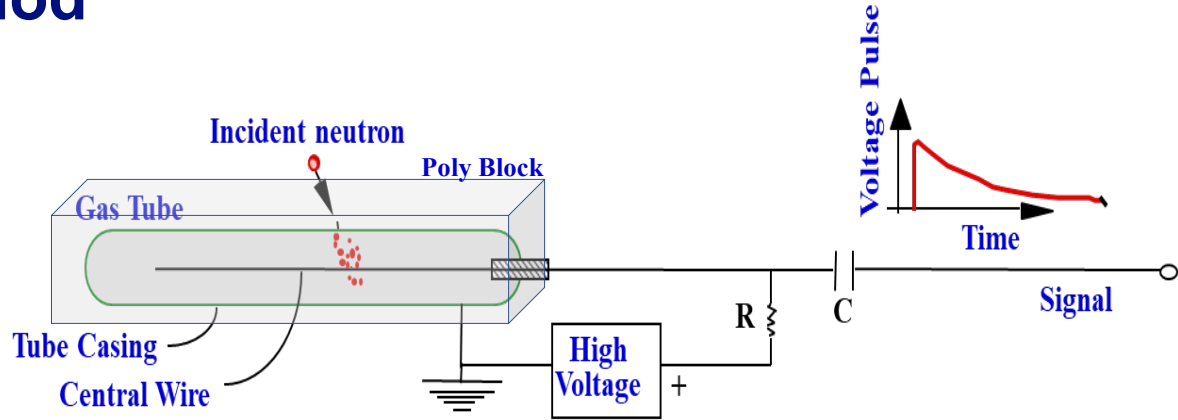
Traditional Method for Amplifier Matching for NDA Detector Systems

Carlos Rael

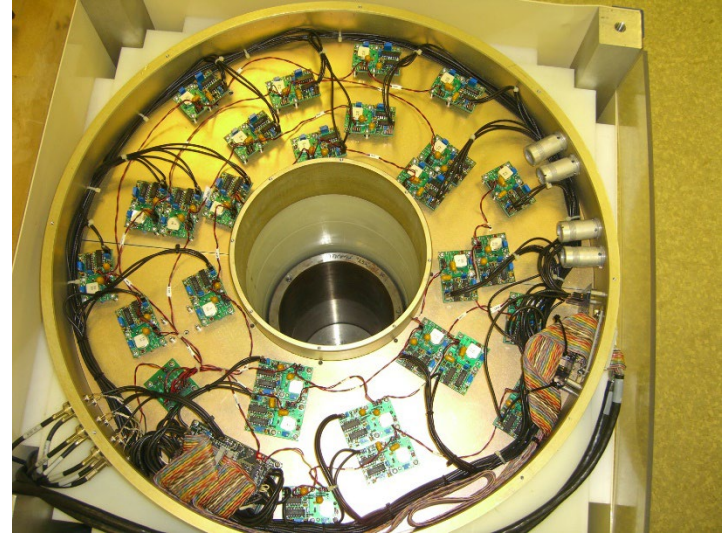
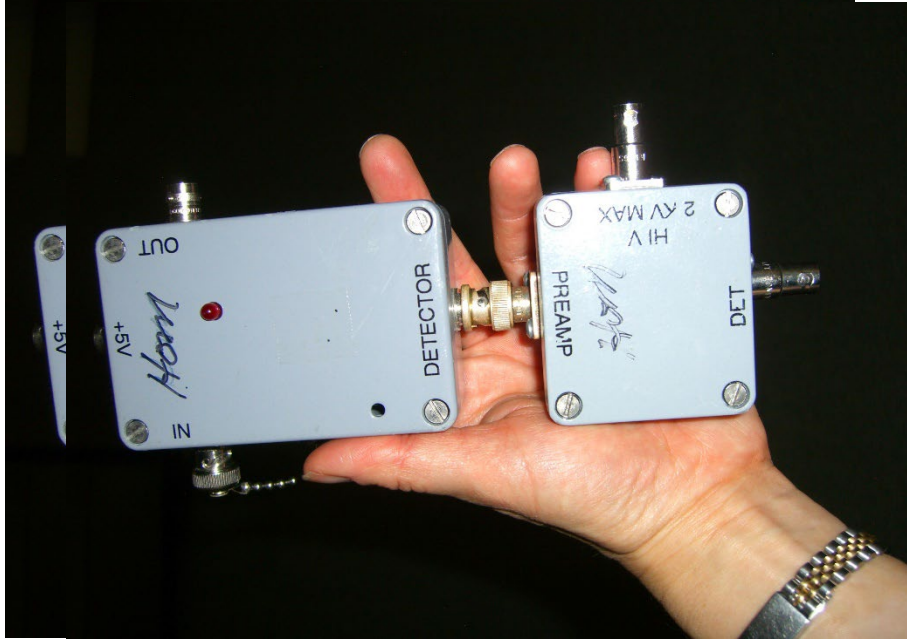
January 18, 2022

Traditional Method

- Requirements
 - Test setup
 - Poly block
 - He-3 tube
 - Amplifier
 - Cf-252 source
 - Data acquisition system (JSR-15 or AMSR-150)



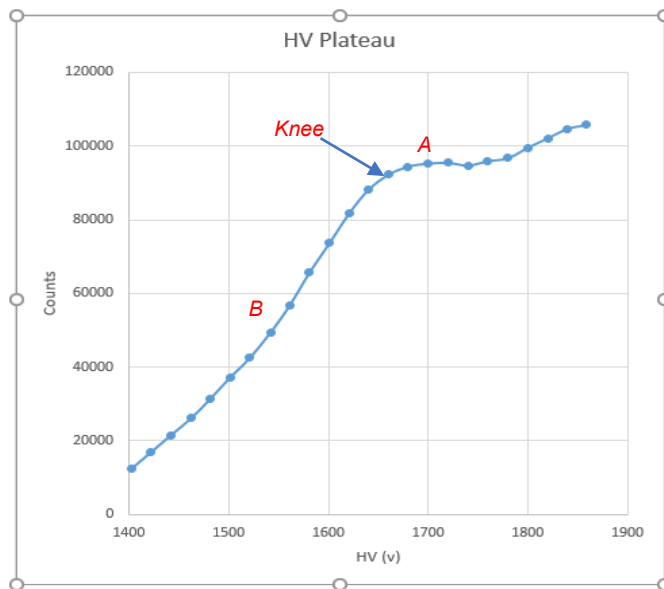
Test Setup



Jimmy Box containing the A111 Amptek Amplifier and High Voltage Filter (left) Or a Detector Junction Box (right)

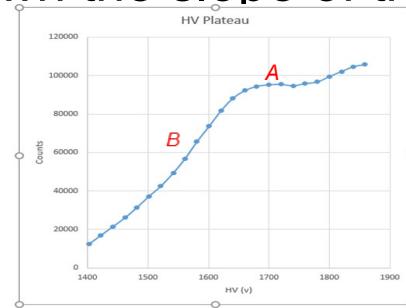
Setting up the Reference Amplifier

- Choose one of the amplifiers from the system
 - Collect a high voltage plateau
 - Make adjustments to the gain to set your operating voltage (typically 1680 or 1720 volts). The operating voltage is usually 40 volts above the knee



Setting up the Reference Amplifier

- Once the operating voltage has been determined
 - Choose a point on the plateau, point **A**
 - Choose a point about half way down the slope of the plateau curve, point **B**
 - Calculate the ratio
 - $Ratio = \frac{A}{B}$
 - The ratio should be about 2.0
 - For the subsequent amplifiers to be gain matched
 - Assemble in to the test setup
 - Set high voltage on the Shift Register to the value the corresponds to point **A**, collect counts



Gain Matching Subsequent Amplifiers

- Divide the counts from point **A** by the *Ratio*
 - The result is the expected counts at point **B**
- Set the high voltage to the voltage that corresponds to point **B**, adjust the gain on the amplifier to obtain the expected counts
- Use the values measured for A and B to calculate the ratio for this amplifier and record the ratio, and the counts of **A** and **B** on a table. The recorded ratio should with in 1% of our reference value.

Amplifier ID	Point A (1700 V)	Point B (1520 V)	Ratio ($R = \frac{A}{B}$)

Gain Matching Subsequent Amplifiers

- Continue this procedure until all amplifiers have been matched
- NOTE:
 - Test set up can be the a bench top system as shown before or the detector system it self.

